Toward Understanding How Users Respond to Rumours in Social Media

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Problem

- A rumour is a statement whose true value is unverifiable.

- Information received via friends tends to be trusted.

- Online Social Networks (OSNs) allow individuals to transmit information to many friends at once.
  - a rich environment for rumor propagation.

→ There is an urgent need to understand how rumours are propagated and their characteristics in OSNs.

Motivation

- Current research about rumours in OSNs:
    - detect rumours.
    - limit the spread of rumours.
    - identify the source of rumours.

- Most of the work in this emerging area has been conducted in Computer Science.

- Other established disciplines may provide valuable insights.

→ Who and why people spread rumours in OSNs from a social science perspective?

Related Work

- Buntain and Golbeck [1]:
  - identify "answer-person" role in Reddit based on user interactions.
  - this role only respond to questions by other users and do not get involved in other discussions.

- Bordia and DiFonzo [2] studied why people spread rumours from a social science perspective.

1. C. Buntain and J. Golbeck, "Identifying social roles in reddit using network structure," in Proceedings of the Companion Publication of the 23rd International Conference on World Wide Web Companion. International World Wide Web Conferences Steering Committee, 2014, pp. 615–620
2. Bordia, P., & DiFonzo, N. (2005). Psychological motivations in rumor spread. *Rumor mills: The social impact of rumor and legend*, 87-101.

Research Questions

Based on user activities in Reddit:

1. Determine if there is a specific group of users that is greatly interested in discussing and spreading rumours?

2. Determine if there is a rumour-spreading personality type in Reddit who, for example, "Generally supports a false rumour" (SUPPORT), "Generally refutes a false rumour" (REFUTE), or "Generally jokes about a false rumour" (JOKE)?

3. Will visualizing rumour spread in Reddit provide better insight into how users interact with rumours?

Our contributions

- Collecting and analysing user posting behaviours in Reddit about a specific rumour. Based on users' interaction, determine if there is a group of users that is actively spreading rumours.

- Using social network analysis, visual analysis, content analysis, and text mining techniques, the system classifies the active rumour-spreading users into one of the three categories: (1) SUPPORT, (2) REFUTE, and (3) JOKE.

- The experimental results using text mining techniques confirm and support our approach.

Why Reddit?

Reddit:

- claims to be the front page of the Internet.

- is an entertainment, social networking service and news aggregator.
  - members can submit content, such as text posts or direct links.

Reddit vs. other OSNs:

- Other OSNs only circulate news through known cycles (e.g., friend or "follow" connections).

- Reddit promotes a constant stream of new links to all users.

→ ***This makes Reddit a effective source to study the spread of rumours in OSNs.***

Bordia and Difonzo Rumour Spread Theory

- **Self-enhancement (SUPPORT):**
  - are either consciously or unconsciously simply spreading rumours.

- **Fact-finding (REFUTE):**
  - aim to arrive at a valid and accurate understanding of rumours through a problem-solving process.

- **Relationship-building (JOKE):**
  - are simply interested in interacting with other people by sharing information about particular rumours.

Methodology

- To study the spread of rumours in Reddit, we need the following elements:
    - 1) A rumour.
    - 2) The truth about this rumour.
    - 3) Posts about this rumour.

- Data Collection:
    - searched the keywords "Obama & Muslim" from Reddit.
    - collected 195 submissions, 26,421 comments from 11,125 users.
    - the number of users with more than 10 comments is 163.
    - used Snopes.com to debunk this rumour as a false rumour.

- Two judges review comments of these 163 users and categorize them into one of the three categories SUPPORT, REFUTE, and JOKE.

Approach to Analysis

- **Social network analysis** (SNA) refers to the use of network theory:
  - understand social network data.

- **Content analysis** is a qualitative method:
  - examine the meaning of textual data manually to identify and assess themes and patterns.

- **Text mining techniques**, such as data classification, visualization, and sentiment analysis:
  - validate if the characteristics of each user group found from social network analysis and content analysis could be classified automatically.

- **Visual Analysis:** uses RumourFlow [1], a service-oriented visualization framework to collect and visualize rumour spread in Reddit.

1. Dang, A., Moh'd, A., Milios, E., & Minghim, R. (2016, June). What is in a Rumour: Combined Visual Analysis of Rumour Flow and User Activity. In Proceedings of the 33rd Computer Graphics International (pp. 17-20). ACM.

Results - Rumour-discussing Users

TABLE II: Rumour-spreading users about the "Obama is a Muslim" rumour.

Rumour-spreading Users	User Count	Percentage
SUPPORT	8	4.9%
REFUTE	41	25.2%
JOKE	85	52.1%
OTHERS	33	20.2%

TABLE III: Examples of user comments in each category.

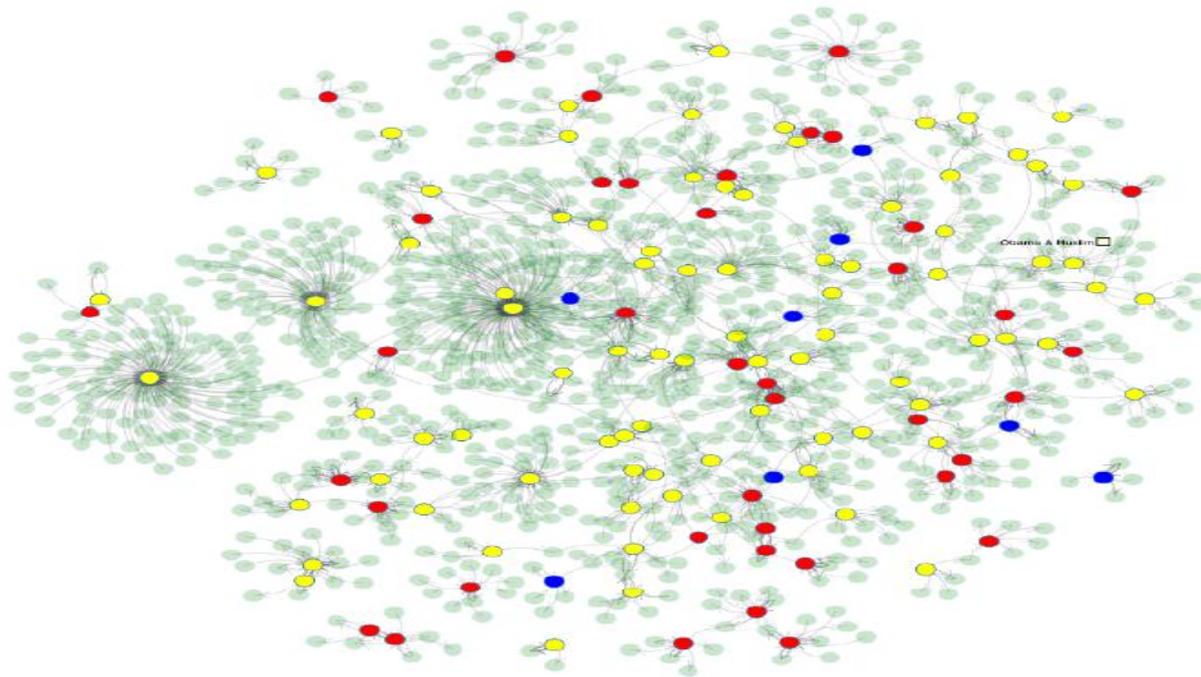| Category	Comments
SUPPORT	"He is a Muslim clearly."
REFUTE	"This is actually a good point. The radical conservative movement doesn't use language like the rest of the people. They don't say what they mean, or what they think is true. They say things to achieve the desired result. So, if they think saying Obama is a Muslim will damage him, by all means they will say that. They use "words that work"?"
JOKE	"?Eh you should come to the south and meet the people I have. Many people seriously believe he's Muslim. Many people also think men have less ribs than women despite that we know 100% it's not true. People are stupid."

Results - Cross-Category User Interactions

- JOKE category tended to receive more responses from other users.

- Users in REFUTE and JOKE categories share many interactions between them

TABLE V: Interactions between user groups; each row represents how frequently users in that category reply to comments or submissions in each of the three categories.

Number of connections	SUPPORT	REFUTE	JOKE
SUPPORT	N/A	N/A	N/A
REFUTE	25	5	4
JOKE	63	49	34

Results - Cross-Category User Interactions (cont.)

(3)

Fig. 3: An example of "who replies to whom" ground-truth user graph. Yellow nodes: users in JOKE category. Red nodes: users in REFUTE category. Blue nodes: users in SUPPORT category. Green nodes: users that have no more than 10 comments but has a connection to the users in one of the three categories.

Results – Content Analysis

- Users in SUPPORT:
  - posted only one or two comments about this rumour.
  - were usually very short and had no back-up evidence or explanation.
    - *"I think he's a Muslim too"*

- Users in JOKE:
  - usually made a sarcastic comment or joke to refute this rumour.
    - *"Mitt Romney's Birth Certificate. His Father was born in Mexico. Romney is just as 'foreign' as Obama is Kenyan or Muslim."*

Results – Content Analysis (cont.)

- For users in REFUTE:
  - many comments were very thoughtful and provided in-depth explanations.
    - *"Right, a politician would never lie or dissemble. If Obama says it, it must be true. I don't think Obama is a covert Muslim, but I wouldn't be surprised to learn that at some point in his life he was saying the [Shahadah.](http://en.wikipedia.org/wiki/Shahadah) His father was a Muslim before being an atheist. His mother ran off with a man to Indonesia and brought Barack Hussein with to the most populous Muslim nation. Barack doesn't strike me as a Muslim, but he may have real Muslim sympathies and may well have been exposed to Muslim indoctrination in his youth. Rejecting this possibility on the word of a lawyer and politician is your prerogative, but I prefer rational skepticism when it comes to politics."*

Results – Sentiment Analysis

- Polarity score represents if a user category is associated with the entity positive or negative.

- Subjectivity score depicts how much sentiment a user category garner.

- REFUTE has the highest polarity and subjectivity scores.

- SUPPORT has the lowest polarity and subjectivity scores.

TABLE VI: Polarity and Subjectivity Score of Each User Category.

Category	Polarity	Subjectivity
SUPPORT	0.484	0.680
REFUTE	0.747	0.753
JOKE	0.638	0.705

Results – Classifying Rumour-spreading Users

- Transform each user comment data into a TF-IDF vector.

- Apply NaivesBayes classifier to those vectors.

- Classify each user into one of the three groups: SUPPORT, REFUTE, and JOKE.

- 80% accuracy using 10 fold cross validation and the feature dimension of the vector is 200.

Threats to Validity

- Our evaluation is based on a case study and our own observations about our method, both threats to external validity.

- Redditors can, and do, change their usernames, create new identities, or update/delete their own comments or submissions.

- In this case study, we focus on a false rumour that was debunked by Snopes.
  - investigate if the proposed approach is still valid for rumours that are only partly false.

Conclusions

- We present a study about how users interact with rumours in Reddit.

- The results have shown that a specific group of users actively interacted with the chosen rumour.

- These users are categorized into three groups: (1) "Generally support a false rumour", (2) "generally refute a false rumour", and (3) "Generally joke about a false rumour".

- The use of social network analysis, content analysis, visualizations, sentiment analysis, and text classifications validate and support the proposed approach.

- Questions

- https://web.cs.dal.ca/~anh/